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(54) **ROLLING VEHICLE LAUNCH CONTROL TECHNIQUES**

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B60W 10/22	(2006.01)
B60W 30/18	(2012.01)

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CPC ***B60W 30/18027*** (2013.01); ***B60W 10/04*** (2013.01); ***B60W 10/10*** (2013.01); ***B60W 10/22*** (2013.01); *B60W 2510/104* (2013.01); *B60W 2520/10* (2013.01); *B60W 2540/10* (2013.01); *B60W 2540/16* (2013.01); *B60W 2710/06* (2013.01); *B60W 2710/10* (2013.01); *B60W 2710/22* (2013.01)

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USPC 477/34; 701/54, 65
See application file for complete search history.

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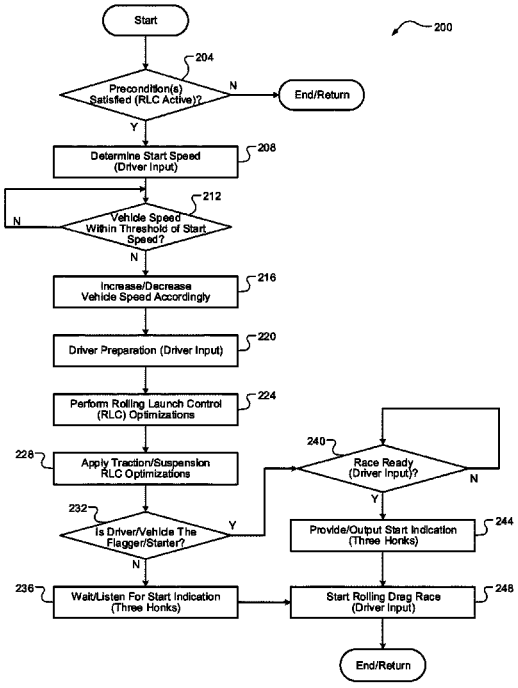
(57) **ABSTRACT**

Rolling launch control techniques for a vehicle involve a set of devices configured to obtain rolling launch control information including at least a start speed for a rolling drag race including the vehicle and a controller configured to control a powertrain of the vehicle such that the vehicle maintains the start speed until the start of the rolling drag race, receive a first driver input in preparation for the rolling drag race, the first driver input including at least a fully-depressed accelerator pedal, optimally adjust settings of at least one of the powertrain and a driveline of the vehicle based on the rolling launch control information, and in response to a start signal or indication for the rolling drag race, stop maintaining the vehicle start speed and launch the vehicle with the fully-depressed accelerator pedal and the optimized powertrain/driveline settings.

20 Claims, 2 Drawing Sheets



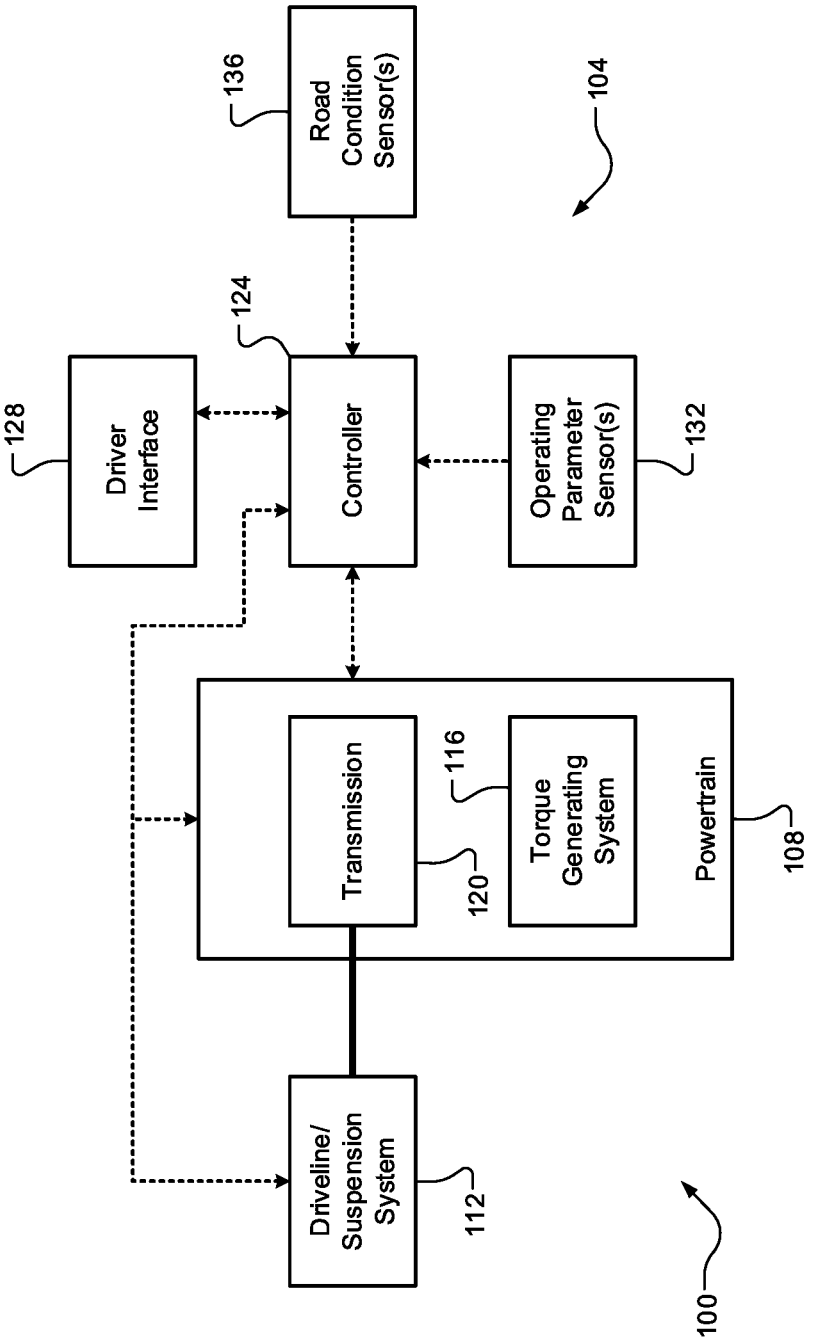

Road Condition Sensor(s)
136
104
124
Driver Interface
128
Controller
Operating Parameter Sensor(s)
132
Transmission
116
Torque Generating System
120
Powertrain
108
Driveline/ Suspension System
112
100

FIG. 1

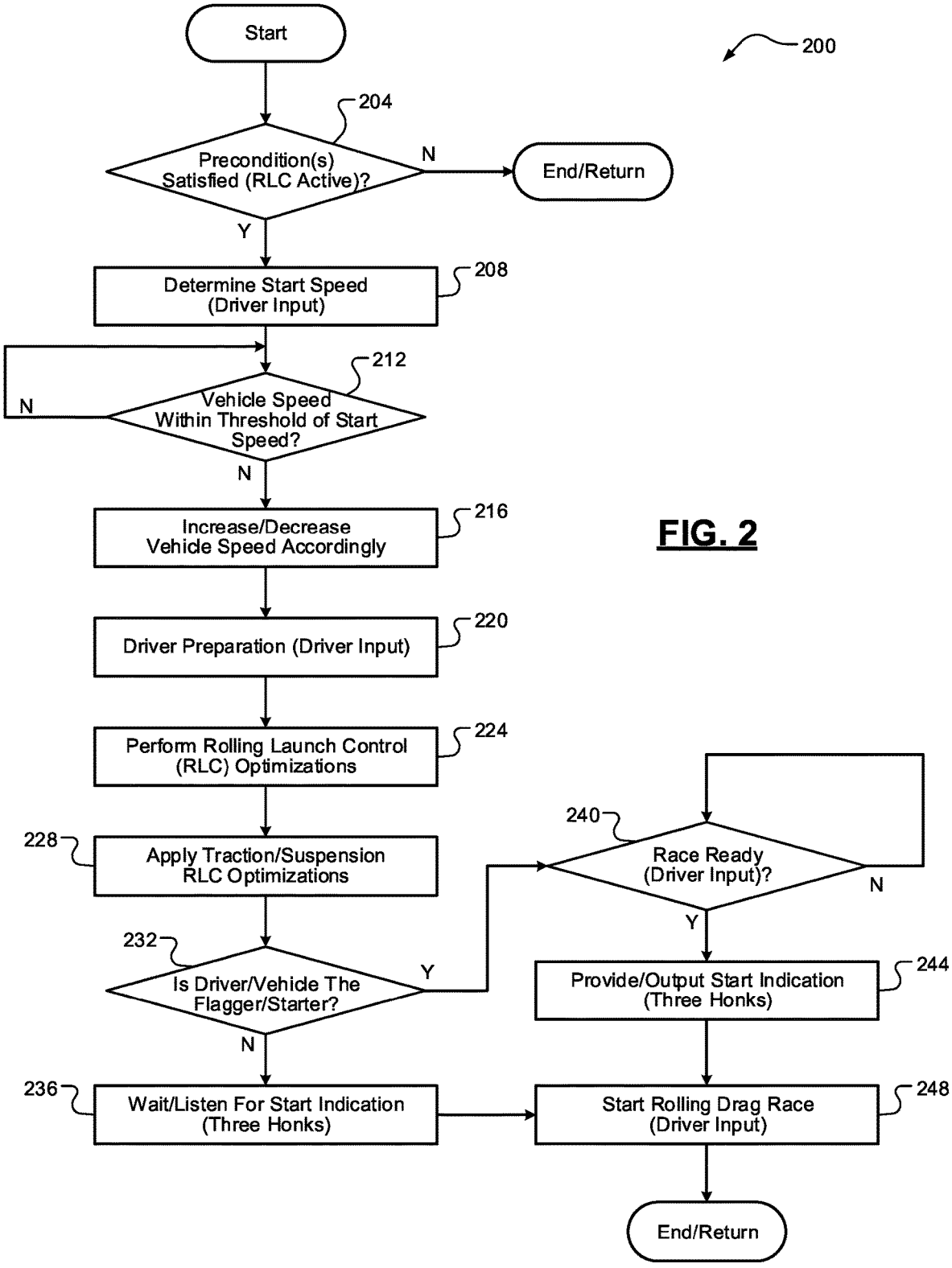

Start
200
204
Precondition(s) Satisfied (RLC Active)?
N
End/Return
Y
Determine Start Speed (Driver Input)
208
212
Vehicle Speed Within Threshold of Start Speed?
N
N
Increase/Decrease Vehicle Speed Accordingly
216
Driver Preparation (Driver Input)
220
Perform Rolling Launch Control (RLC) Optimizations
224
228
Apply Traction/Suspension RLC Optimizations
232
Is Driver/Vehicle The Flagger/Starter?
Y
N
236
Wait/Listen For Start Indication (Three Honks)
240
Race Ready (Driver Input)?
N
Y
Provide/Output Start Indication (Three Honks)
244
Start Rolling Drag Race (Driver Input)
248
End/Return

FIG. 2

ROLLING VEHICLE LAUNCH CONTROL TECHNIQUES

FIELD

The present application generally relates to vehicle launch control and, more particularly, to techniques for rolling vehicle launch control.

BACKGROUND

Conventional vehicle launch control is focused only on controlling vehicle launches from a stop or a standstill. This includes, for example, organized drag racing events. Another popular comparative performance metric is a rolling vehicle drag race, which involves each vehicle launching from the same rolling speed (e.g., 40 miles per hour). Conventional rolling vehicle drag races involve one vehicle providing a start indication (e.g., three honks of the signaling vehicle's horn), upon which each participating vehicle transitions to maximum acceleration or "wide-open throttle" (WOT). Many inexperienced drivers, however, may not be sure what settings to use in their vehicle (traction control, suspension settings, gear position, throttle position, etc.) during rolling drag races. This frequently leads to sub-optimal acceleration rates during a rolling drag race (e.g., the vehicle may have to downshift immediately, which can waste time, or the selected gear may be too high, which will cause the vehicle acceleration rate to be slower than desired). Thus, while conventional vehicle launch control systems do work well for their intended purpose, an opportunity exists for improvement in the relevant art.

SUMMARY

According to one example aspect of the invention, a rolling launch control system for a vehicle is presented. In one exemplary implementation, the rolling launch control system comprises a set of devices configured to obtain rolling launch control information for a rolling drag race including the vehicle, the rolling launch control information including at least a start speed for the rolling drag race and a controller configured to control a powertrain of the vehicle such that the vehicle maintains the start speed until the start of the rolling drag race, receive a first driver input in preparation for the rolling drag race, the first driver input including at least a fully-depressed accelerator pedal, optimally adjust settings of at least one of the powertrain and a driveline of the vehicle based on the rolling launch control information, and in response to a start signal or indication for the rolling drag race, stop maintaining the vehicle start speed and launch the vehicle with the fully-depressed accelerator pedal and the optimized powertrain/driveline settings.

In some implementations, the start speed for the rolling drag race is provided by the driver as a driver input or is communicated to the vehicle by another vehicle participating in the rolling drag race. In some implementations, the rolling launch control information includes at least one of a plurality of operating parameters of the powertrain and a plurality of conditions of a road along which the vehicle is traveling. In some implementations, the driveline settings include at least one of traction control settings and suspension settings. In some implementations, the first driver input further includes the driver holding one of two steering wheel paddle shifters of the vehicle. In some implementations, the controller is configured to launch the vehicle in response to a second driver input that includes the driver releasing the one of the two steering wheel paddle shifters.

In some implementations, the controller is further configured to determine whether the vehicle is a starter/flagger vehicle for the rolling drag race. In some implementations, when the vehicle is the starter/flagger vehicle for the rolling drag race, the controller is further configured to automatically output the start signal or indication for the rolling drag race. In some implementations, the controller is configured to automatically output the start signal or indication for the rolling drag race in response to the driver providing a second driver input. In some implementations, the second driver input is holding the other of the two paddle shifters, and wherein the start signal or indication is three successive honks of a horn of the vehicle.

According to another example aspect of the invention, a rolling launch control method for a vehicle is presented. In one exemplary implementation, the rolling launch control method comprises receiving, by a controller and from a set of devices, rolling launch control information for a rolling drag race including the vehicle, the rolling launch control information including at least a start speed for the rolling drag race, controlling, by the controller, a powertrain of the vehicle such that the vehicle maintains the start speed until the start of the rolling drag race, receiving, by the controller, a first driver input in preparation for the rolling drag race, the first driver input including at least a fully-depressed accelerator pedal, optimally adjusting, by the controller, settings of at least one of the powertrain and a driveline of the vehicle based on the rolling launch control information, and in response to a start signal or indication for the rolling drag race, stopping maintaining the vehicle start speed and launching, by the controller, the vehicle with the fully-depressed accelerator pedal and the optimized powertrain/driveline settings.

In some implementations, the start speed for the rolling drag race is provided by the driver as a driver input or is communicated to the vehicle by another vehicle participating in the rolling drag race. In some implementations, the rolling launch control information includes at least one of a plurality of operating parameters of the powertrain and a plurality of conditions of a road along which the vehicle is traveling. In some implementations, the driveline settings include at least one of traction control settings and suspension settings. In some implementations, the first driver input further includes the driver holding one of two steering wheel paddle shifters of the vehicle. In some implementations, launching the vehicle is performed by the controller in response to a second driver input that includes the driver releasing the one of the two steering wheel paddle shifters.

In some implementations, the method further comprises determining, by the controller, whether the vehicle is a starter/flagger vehicle for the rolling drag race. In some implementations, when the vehicle is the starter/flagger vehicle for the rolling drag race, the method further comprises automatically outputting, by the controller, the start signal or indication for the rolling drag race. In some implementations, automatically outputting the start signal or indication for the rolling drag race is performed by the controller in response to the driver providing a second driver input. In some implementations, the second driver input is holding the other of the two paddle shifters, and wherein the start signal or indication is three successive honks of a horn of the vehicle.

Further areas of applicability of the teachings of the present application will become apparent from the detailed description, claims and the drawings provided hereinafter,

wherein like reference numerals refer to like features throughout the several views of the drawings. It should be understood that the detailed description, including disclosed embodiments and drawings referenced therein, are merely exemplary in nature intended for purposes of illustration only and are not intended to limit the scope of the present disclosure, its application or uses. Thus, variations that do not depart from the gist of the present application are intended to be within the scope of the present application.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a functional block diagram of a vehicle having an example rolling launch control system according to the principles of the present application; and

FIG. **2** is a flow diagram of an example rolling launch control method for improved rolling drag racing performance by a vehicle according to the principles of the present application.

DESCRIPTION

As previously discussed, in addition to conventional (standstill) drag racing, such as at organized/legal drag racing events, another popular comparative performance metric is a rolling vehicle drag race, which involves each vehicle launching from the same rolling speed (e.g., 40 miles per hour). This is because in rolling drag racing, traction control issues are less of an issue compared to conventional standstill drag racing. During rolling drag racing, the driver is required to select the correct gear and other vehicle settings (traction control, suspension, etc.) manually. The driver also has to hold the start speed manually by controlling the throttle and brake pedals, as well as sometimes providing a start indication (e.g., three honks of the vehicle's horn). Manual selection of vehicle parameters generally requires substantial driver experience with the vehicle and a better understanding of the racing parameters (road conditions, vehicle behavior at the rolling launch speed, etc.).

Sometimes, this type of experience can also be difficult to acquire, due to the nature of rolling drag racing and the limited scenarios where it can safely occur. Also, if the driver selects the initial gear manually, the transmission generally defaults to a "manual shifting" mode, and now the driver must continue to manually shift gears during the race, which can add unnecessary complexity and distraction. All of these racing requirements (holding proper vehicle speed while trying to find the correct gear and other settings, steering the vehicle while also possibly signaling the start of the race and observing the other vehicle(s) to make sure the driver(s) is/are ready, etc.) can become overwhelming to the inexperienced driver. Thus, an opportunity for improvement exists in the relevant art.

Accordingly, improved rolling vehicle launch control techniques for improved rolling drag racing performance are presented herein. The techniques obtain inputs from the driver as well as several vehicle parameters in order to achieve an optimal acceleration rate while the vehicle is in motion. The driver can input, for example, a desired start speed, and the vehicle will then shift into the appropriate gear and hold the desired speed until a driver input is given to accelerate at the highest rate possible (e.g., wide-open throttle, or WOT). Other powertrain preconditioning could also be performed, such as generating a torque reserve (engine spark retardation, air/exhaust flow management for a turbocharger/supercharger, air/exhaust gas cooling, battery or fuel cell management, etc.) which could then be depleted during the rolling drag race.

Additionally, based on road conditions there may be an optimal traction control/suspension/etc. setting that would work best, which along with the previously mentioned parameters can be selected automatically by the vehicle with the proposed rolling launch control (RLC) feature. This allows for the driver to focus on steering and the rolling drag race itself, rather than manually performing all of these actions. The potential benefits include improved rolling drag racing performance and an improved driver experience. It will be appreciated that the usage of these techniques could be limited to specific scenarios such as organized/legal drag racing events or at similar locations (a drag strip, a track, or the like).

Referring now to FIG. **1**, a functional block diagram of a vehicle **100** having an example rolling launch control (RLC) system **104** according to some implementations of the present application is illustrated. The vehicle **100** includes a powertrain **108** configured to generate and transfer drive torque to a driveline/suspension system **112** (hereinafter, "driveline" or "driveline system") for vehicle propulsion. The powertrain **108** includes a torque generating system **116** configured to generate drive torque and a transmission **120** (e.g., a multi-speed automatic transmission) configured to transfer the drive torque from the torque generating system **116** to the driveline **112**. The powertrain **108** and, more particularly, the torque generating system **116** could have any suitable configuration (e.g., an internal combustion engine, one or more electric motors, or some combination thereof). A controller **124** is configured to control operation of the vehicle **100** including controlling the powertrain **108** to generate and transfer a desired amount of drive torque to the driveline **112** to satisfy a torque request. The torque request could be provided, for example, by a driver of the vehicle **100** via a driver interface **128**.

Non-limiting examples of the driver interface **128** include an accelerator pedal, a brake pedal, a transmission gear selector, a steering wheel, steering wheel paddle shifters (e.g., left and right paddle shifters), a horn actuator, and a touch display. The controller **124** is also configured to perform at least a portion of the techniques of the present application, which will be described more fully below. The controller **124** is configured to receive a plurality of inputs, such as measured operating parameters (vehicle speed, shaft speeds, temperatures, current gear, current driveline/suspension settings, etc.) from a set of operating parameter sensors **132** and measured road conditions (altitude, road grade, surface type, surface friction level, etc.). It will be appreciated that these are merely examples of different parameters that could be utilized to optimize the powertrain **108** and the driveline **112** for operation during the rolling drag race and that other suitable parameters could also be monitored/sensed and taken into account by the controller **124**. The driver interface **128** and the sets of sensors **132**, **136** are also referred to collectively herein as "a set of devices" that are configured to collectively obtain (receive/measure) "rolling launch control information" for rolling drag race.

Referring now to FIG. **2**, a flow diagram of an example rolling launch control (RLC) method **200** for improved rolling drag racing performance by a vehicle according to some implementations of the present application is illustrated. While the vehicle **100** and its components are specifically referenced for illustrative/descriptive purposes, it will be appreciated that the method **200** could be applicable to any suitably configured vehicle. At **204**, the controller **124**

determines whether an optional set of one or more preconditions are satisfied. This set of optional precondition(s) could include, for example only, there being no malfunctions present that would inhibit operation of the vehicle **100** (e.g., the powertrain **108**) or the operation of the rolling launch control (RLC) system **104**. When false, the method **200** ends or returns to **204**.

These precondition(s) could also include the RLC feature being active or engaged (e.g., in response to a driver input or selection). In some implementations, these precondition(s) could also include safety-related preconditions, such as information verifying that the vehicle **100** is at an organized/legal drag racing event or similar area. For example only, geo-fencing could be used to verify the vehicle's location at an allowed area (a drag strip, a track, or the like) for usage of the features of the present application. When true, the method **200** continues to **208**.

At **208**, the controller **124** determines a start speed for the vehicle **100** to maintain until the start of the rolling drag race. In some implementations, the start speed could be predetermined as it could be a widely-accepted value (e.g., 40 mph). This start speed could be, for example, input by the driver via the driver interface **128** (e.g., a selectable knob or a touch display). It will also be appreciated that at least some of the parameters relating to the rolling launch control (RLC) feature of the present application could be communicated between the vehicles, such as via vehicle-to-anything (V2X) communication. This could include short-range wireless communication, such as Bluetooth or WiFi Direct, or longer range wireless communication, such as a cellular network. By sharing information amongst the participating vehicles, the drivers do not need to communicate these parameters (e.g., vehicle start speed). The level or capability of such sharing could depend on the type of the vehicles participating in the rolling drag race. When all of the participating vehicles are made by the same original equipment manufacturer (OEM), a highest level of secured sharing and information usage could be available, which could be desirable to drivers (i.e., to purchase a vehicle from a particular OEM).

At **212**, the controller **124** determines whether the speed of the vehicle **100** is within a threshold amount (e.g., less than 1 mph) from the start speed for the rolling drag race. When true, the method **200** continues to **220**. When false, the method **200** proceeds to **216** where the controller **124** increases or decreases the vehicle speed accordingly and the method **200** returns to **212** until the vehicle speed is within the threshold amount from the start speed. At **220**, driver preparation for the rolling drag race occurs. This includes specific driver input to prepare for the start of the rolling drag race. This could include, for example only, the driver holding down one of the paddle shifters (e.g., a left paddle shifter) and fully-depressing an accelerator pedal (e.g., to WOT). At **224**, the controller **124** then performs rolling launch control (RLC) optimizations. This could include, for example only, automatically applying or configuring specific traction control settings (e.g., acceptable wheel slip) and specific driveline/suspension system settings based on the monitored vehicle/powertrain operating parameters and road conditions (via sensors **132** and **136**). This could also include powertrain preconditioning, such as generating a torque reserve (engine spark retardation, air/exhaust flow management for a turbocharger/supercharger, air/exhaust gas cooling, battery or fuel cell management, etc.) which could then be depleted during the rolling drag race.

At **232**, the controller **124** determines whether the driver is the flagger or starter for the rolling drag race. This could have been predetermined by the drivers prior to entering their vehicles or the driver could have "opted-in" to be the starter/flagger via some sort of vehicle input (e.g., via a touch display). When false, the method **200** continues to **236** where the driver waits (e.g., listens) for the rolling drag race start signal or indication (e.g., three horn honks). When true, however, the method **200** continues to **240** where the driver has provided input indicating that he/she is race ready. This input could include, for example only, holding the other paddle shifter (e.g., the right paddle shifter). Upon receiving the race-ready input, the method **200** proceeds to **244** where the start signal/indication is automatically generated or output by the vehicle **100**. As previously mentioned, this could be three successive honks of the horn of the vehicle **100**. The driver could then stop providing the race-ready input (e.g., release the right paddle shifter). At **248**, the rolling drag race begins and the driver provides driver input to begin the rolling drag race. This could include, for example only, releasing the left paddle shifter and maintaining the fully-depressed accelerator pedal (e.g., WOT). The method **200** then ends or returns to **204** for another cycle.

It will be appreciated that the term "controller" as used herein refers to any suitable control device or set of multiple control devices that is/are configured to perform at least a portion of the techniques of the present application. Non-limiting examples include an application-specific integrated circuit (ASIC), one or more processors and a non-transitory memory having instructions stored thereon that, when executed by the one or more processors, cause the controller to perform a set of operations corresponding to at least a portion of the techniques of the present application. The one or more processors could be either a single processor or two or more processors operating in a parallel or distributed architecture.

It should also be understood that the mixing and matching of features, elements, methodologies and/or functions between various examples may be expressly contemplated herein so that one skilled in the art would appreciate from the present teachings that features, elements and/or functions of one example may be incorporated into another example as appropriate, unless described otherwise above.

What is claimed is:

1. A rolling launch control system for a vehicle, the rolling launch control system comprising:

a set of devices configured to obtain rolling launch control information for a rolling drag race including the vehicle, the rolling launch control information including at least a start speed for the rolling drag race; and

a controller configured to:

control a powertrain of the vehicle such that the vehicle maintains the start speed until a start of the rolling drag race;

receive a first driver input in preparation for the rolling drag race, the first driver input including at least a fully-depressed accelerator pedal;

optimally adjust settings of at least one of the powertrain and a driveline of the vehicle based on the rolling launch control information; and

in response to a start signal or indication for the rolling drag race, stop maintaining the vehicle start speed and launch the vehicle with the fully-depressed accelerator pedal and the optimized powertrain/driveline settings.

2. The rolling launch control system of claim **1**, wherein the start speed for the rolling drag race is provided by the driver as a driver input or is communicated to the vehicle by another vehicle participating in the rolling drag race.

3. The rolling launch control system of claim 1, wherein the rolling launch control information includes at least one of a plurality of operating parameters of the powertrain and a plurality of conditions of a road along which the vehicle is traveling.

4. The rolling launch control system of claim 1, wherein the driveline settings include at least one of traction control settings and suspension settings.

5. The rolling launch control system of claim 1, wherein the first driver input further includes the driver holding one of two steering wheel paddle shifters of the vehicle.

6. The rolling launch control system of claim 5, wherein the controller is configured to launch the vehicle in response to a second driver input that includes the driver releasing the one of the two steering wheel paddle shifters.

7. The rolling launch control system of claim 6, wherein the controller is further configured to determine whether the vehicle is a starter/flagger vehicle for the rolling drag race.

8. The rolling launch control system of claim 7, wherein when the vehicle is the starter/flagger vehicle for the rolling drag race, the controller is further configured to automatically output the start signal or indication for the rolling drag race.

9. The rolling launch control system of claim 8, wherein the controller is configured to automatically output the start signal or indication for the rolling drag race in response to the driver providing a second driver input.

10. The rolling launch control system of claim 9, wherein the second driver input is holding the other of the two paddle shifters, and wherein the start signal or indication is three successive honks of a horn of the vehicle.

11. A rolling launch control method for a vehicle, the rolling launch control method comprising:

receiving, by a controller and from a set of devices, rolling launch control information for a rolling drag race including the vehicle, the rolling launch control information including at least a start speed for the rolling drag race;

controlling, by the controller, a powertrain of the vehicle such that the vehicle maintains the start speed until a start of the rolling drag race;

receiving, by the controller, a first driver input in preparation for the rolling drag race, the first driver input including at least a fully-depressed accelerator pedal;

optimally adjusting, by the controller, settings of at least one of the powertrain and a driveline of the vehicle based on the rolling launch control information; and

in response to a start signal or indication for the rolling drag race, stopping maintaining the vehicle start speed and launching, by the controller, the vehicle with the fully-depressed accelerator pedal and the optimized powertrain/driveline settings.

12. The rolling launch control method of claim 11, wherein the start speed for the rolling drag race is provided by the driver as a driver input or is communicated to the vehicle by another vehicle participating in the rolling drag race.

13. The rolling launch control method of claim 11, wherein the rolling launch control information includes at least one of a plurality of operating parameters of the powertrain and a plurality of conditions of a road along which the vehicle is traveling.

14. The rolling launch control method of claim 11, wherein the driveline settings include at least one of traction control settings and suspension settings.

15. The rolling launch control method of claim 11, wherein the first driver input further includes the driver holding one of two steering wheel paddle shifters of the vehicle.

16. The rolling launch control method of claim 15, wherein launching the vehicle is performed by the controller in response to a second driver input that includes the driver releasing the one of the two steering wheel paddle shifters.

17. The rolling launch control method of claim 16, further comprising determining, by the controller, whether the vehicle is a starter/flagger vehicle for the rolling drag race.

18. The rolling launch control method of claim 17, wherein when the vehicle is the starter/flagger vehicle for the rolling drag race, the method further comprises automatically outputting, by the controller, the start signal or indication for the rolling drag race.

19. The rolling launch control method of claim 18, wherein automatically outputting the start signal or indication for the rolling drag race is performed by the controller in response to the driver providing a second driver input.

20. The rolling launch control method of claim 19, wherein the second driver input is holding the other of the two paddle shifters, and wherein the start signal or indication is three successive honks of a horn of the vehicle.

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